

A (tentative) review of GEWEX Phase-II Roadmap

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WCRP-JSC review team for GEWEX P-II strategy
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Why GEWEX review now (by JSC) ??

- GEWEX is the oldest and longest project under WCRP since 1988. Phase-II should have clear foci.
- GEWEX has been trying to understand very fundamental but tough issues (energy and water cycle and their feedbacks, land surface processes, etc.) of the climate system. So, critical but constructive reviews and comments from climate prediction community may be crucial for its new strategy.
- Contribution to anthropogenic impact studies on energy & water cycle changes (e.g., to IPCC) are now required more seriously from society, and how to respond to this as hydroclimate science community should be addressed.

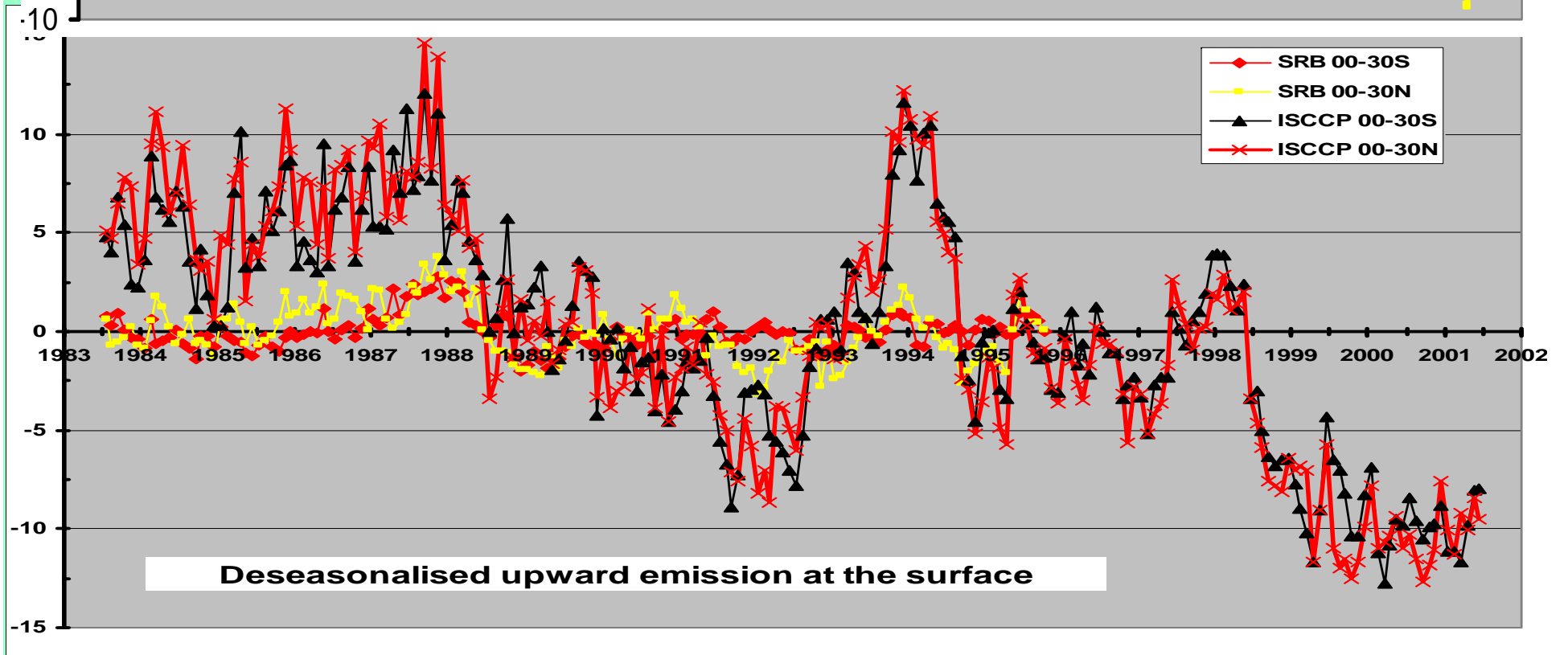
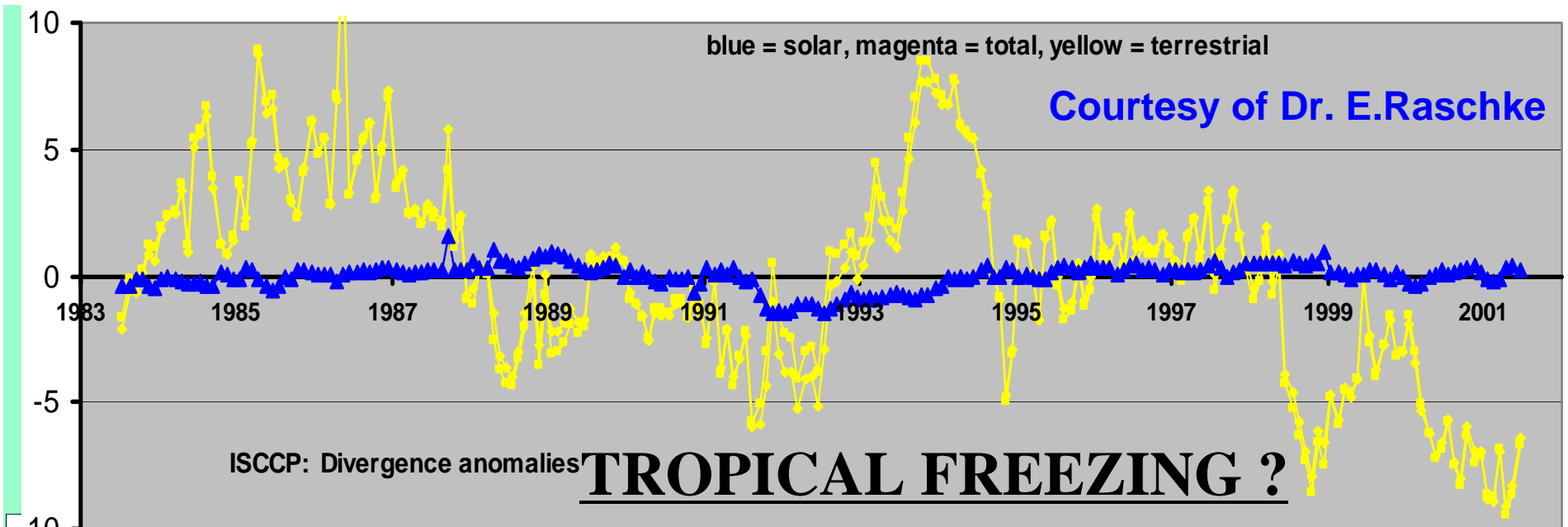
General view

- Although GEWEX is the unique program for having promoted observational and modeling studies on energy and water cycle processes of the climate system for about 20 years, its visibility in the water management community as well as the climate research community is still not so high. GEWEX needs to specify and visualize its role more strongly and clearly (effectively) within and outside of WCRP (e.g., in ESSP).
- To fulfill the objectives in phase-II, coordination of process study (and observation) community and modeling community should be enhanced, particularly through new CSEs and CEOP-2 activities. One important time frame may be 2007/2008, where some CSEs will conduct new IOP (IPY & IMY?).
- Since GEWEX is highly expected to contribute to more quantitative & qualitative estimates of the anthropogenic impacts on changes in global and regional energy & water cycle, the related projects need to consider timelines better to fit with the IPCC 5th report procedure.

Strategy for GEWEX Objective 1:

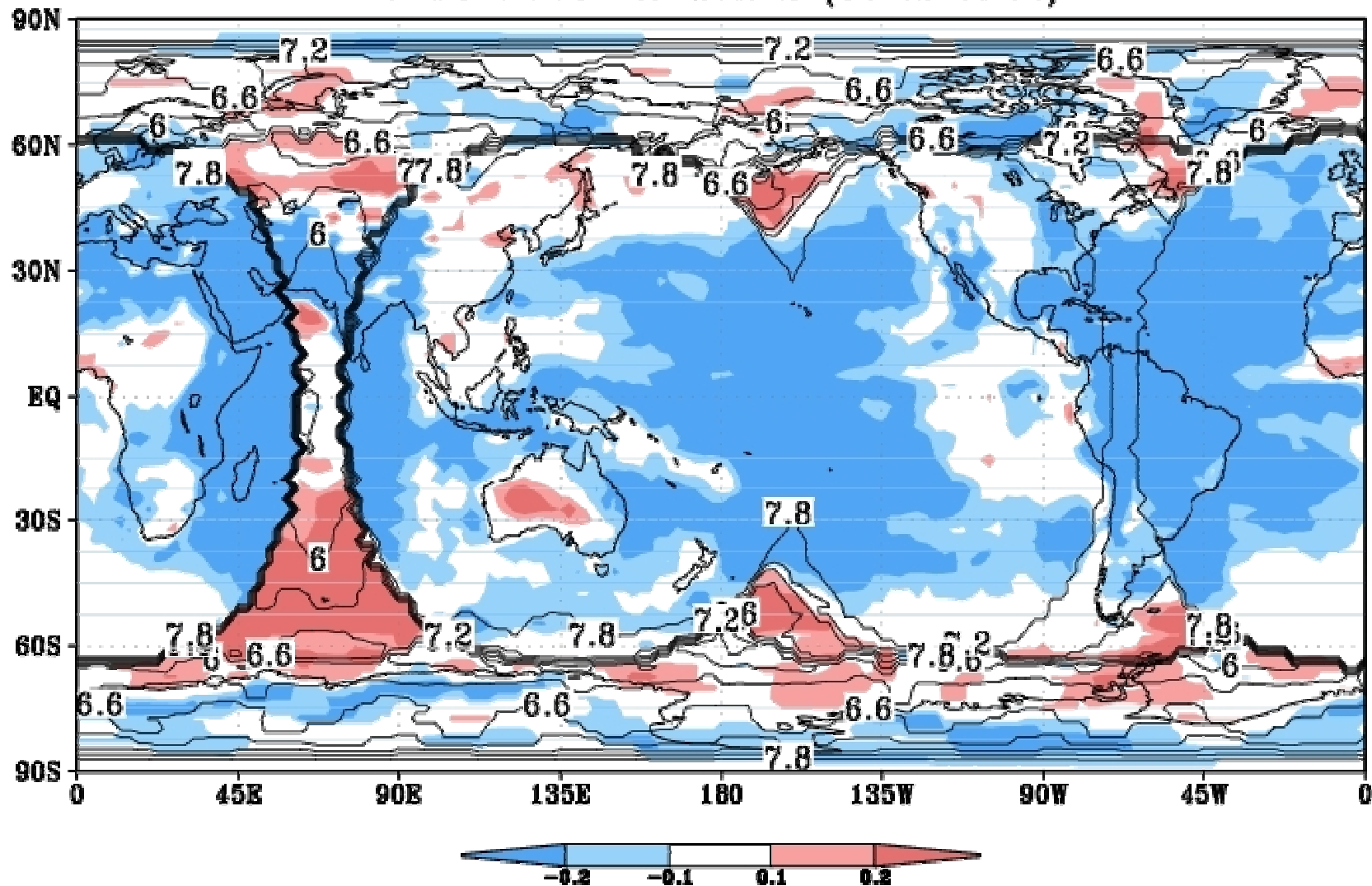
Produce consistent research quality data sets complete with error descriptions of the Earth's energy budget and water cycle and their variability and trends on interannual to decadal time scales, for use in climate system analysis and model development and validation.

- The global-scale GEWEX data sets (e.g., GPCP, ISCCP, ISLSCP, BSRN, GSWP...) should be continued to contribute longer-term climate change studies including the assessment of anthropogenic impacts on the climate system. HOWEVER, a key issue may be how to improve and homogenize the data quality of these data sets.
- To produce better GPCP data, in addition to use of qualified satellite data (of both microwave channels and TRMM-PR), the archive of in-situ (ancillary) station data should be included from world-wide hydro-meteorological agencies. GHP should contribute to this task through the CSEs collaboration of each region and continent.
- GSWP, LandFlux and GLDAS projects should be coordinated tightly with GMPP, which is essential for improving and guaranteeing for initialization and validation of the GLACE-2 numerical experiments.



Linear Trend & Number of Observations (1984-2004) Of ISCCP total cloud amount

Contour: Number of Observations, Shade: Cloud Amount Trend
1984-2004 All Month (TotalCloud)



Strategy for GEWEX Objective 2:

Enhance the understanding of how energy and water cycle processes function and quantify their contribution to climate feedbacks.

- The process studies to fulfill the objective 2 should be made **in regional to continental-scale domain**, since this objective is related to the role of large-scale land-atmosphere interaction and feedbacks in the climate system.
- This implies this objective can be achieved only through well-organized CSEs or regional field campaigns in collaboration **with enhanced observations and high-resolution/quality modelings**.
- These regional-scale projects should **coordinate with CLIVAR (CliC, SPARC), THOPEX (and ESSP for application)** to understand full coupling processes in the climate system.
- **GMPP should be involved** actively in each regional project.

Strategy for *GEWEX Objective 3*:
Determine the geographical and seasonal characteristics of the predictability of key water and energy cycle variables over land areas and through collaborations with the wider WCRP community and determine the predictability of energy and water cycles on a global basis.

Inverse relation between Indian summer monsoon and Eurasian snow cover ?

(Hahn and Shukla, 1976 JAS)

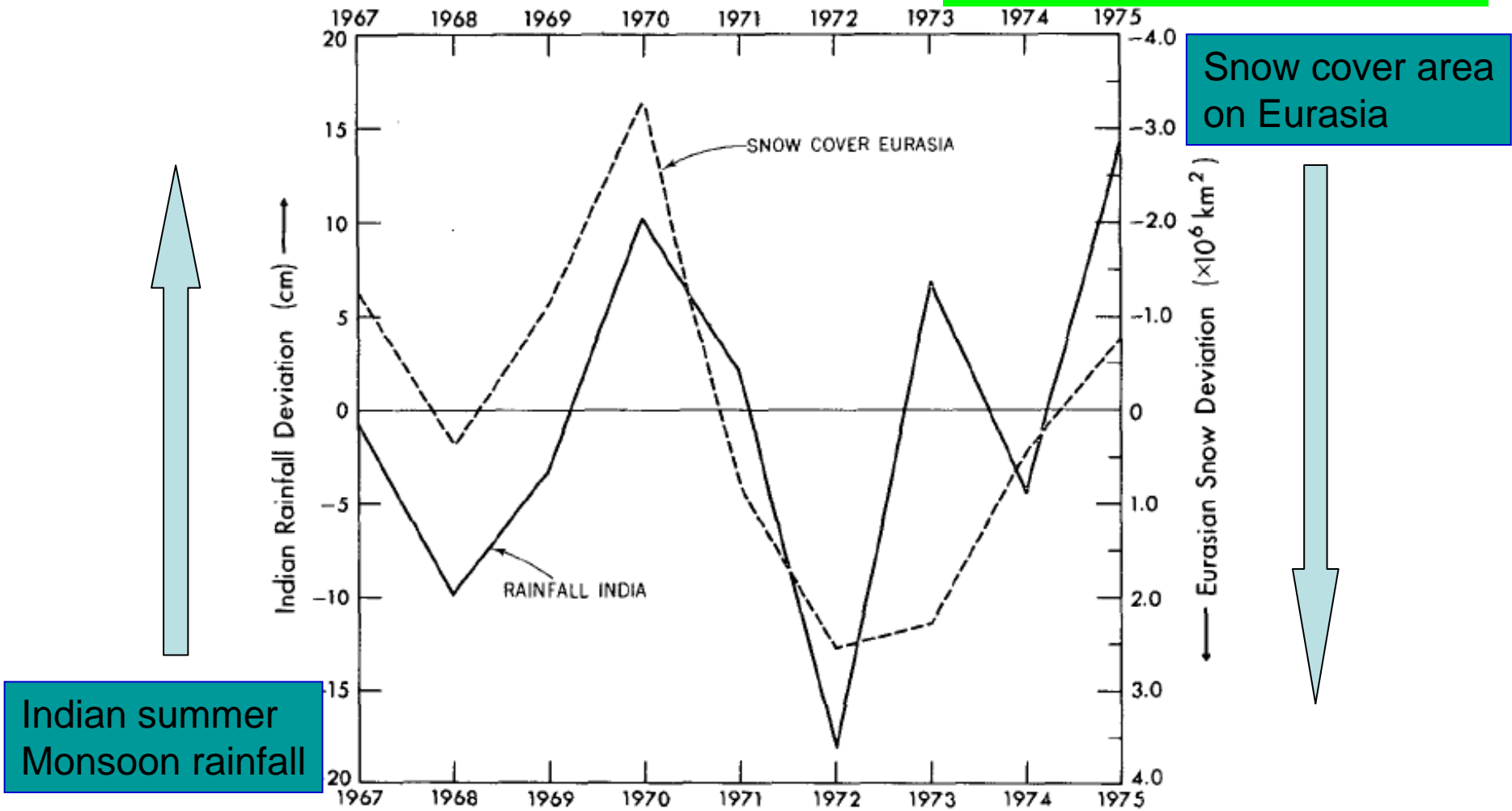
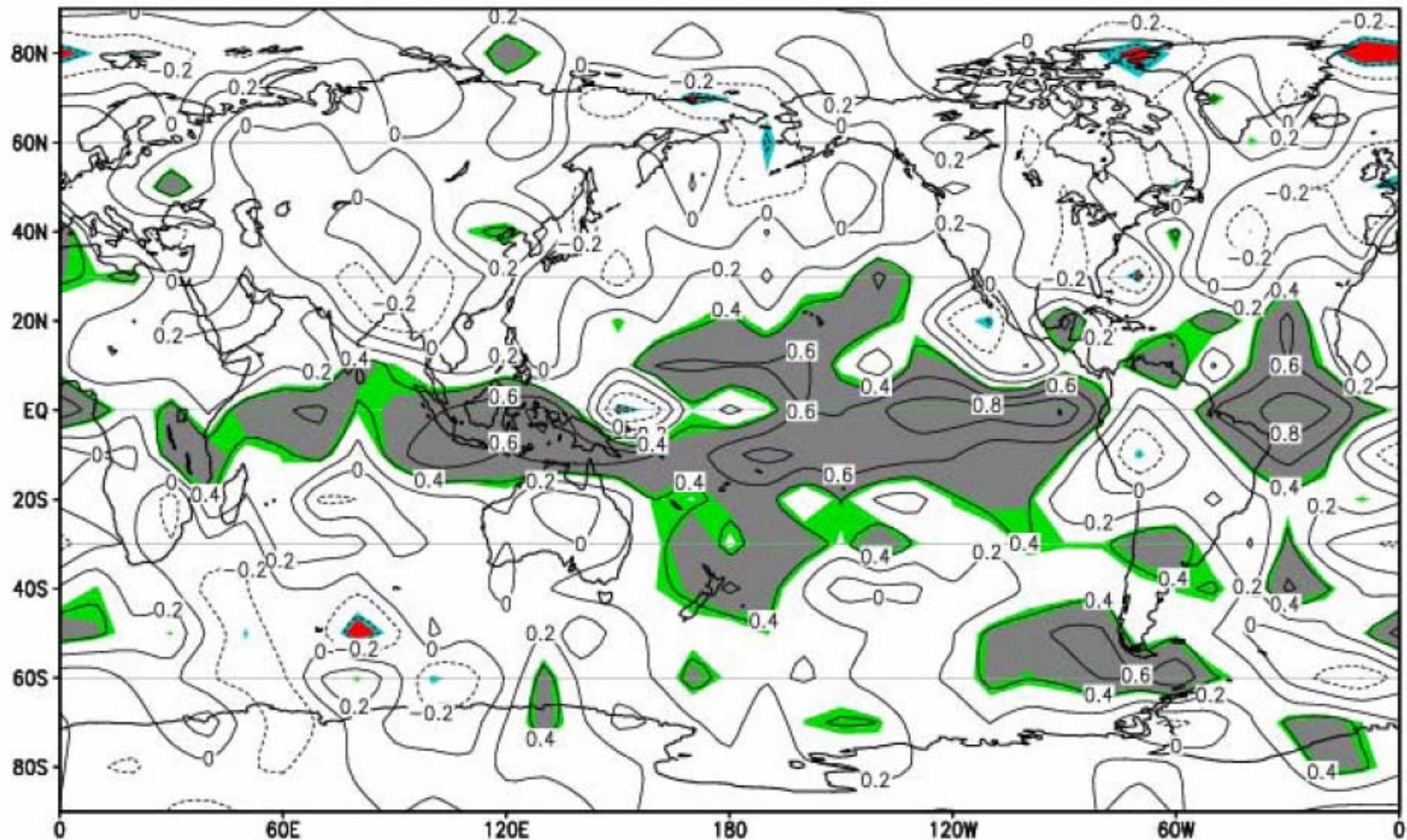


FIG. 1. Graphs of year-to-year variation of winter snow cover departure over Eurasia south of 52°N , and the corresponding variation of summertime area mean rainfall departure for India.

- This objective is directly related to one of the most important objectives of WCRP. GEWEX has been expected to assess and improve predictability of particularly over land areas, including monsoon systems.
- To improve predictability over land, we need a kind of “the second-generation land surface assimilation data” for initialization of GCMs or RCMs, produced by combining in-situ land surface data, high-resolution satellite data and NWP outputs.
- In addition to soil wetness, other important land surface hydro-climate parameters, e.g., snow cover, permafrost and vegetation, need to be considered for predictability of land hydro-climate. both in the initial and boundary conditions, and to simulate seasonal cycle of climate.
- A view of “the accelerating water cycle due to the global warming” should be verified and tested more precisely and exactly using the-state-of-the-arts models,

AMIP-type GCM experiments have completely failed to reproduce precipitation over land areas.
⇒important role of land-atmosphere interactions

CC Bet GPCP(obs)& CCSR-NIES Model Precipitation for JJAS 1979-2000



Strategy for GEWEX Objective 4:
Develop better seasonal predictions of water and energy cycle variability through improved parameterizations encapsulating hydrometeorological processes and feedbacks for atmospheric circulation models.

- For better prediction of precipitation and hydro-climate parameters, improvement of coupling processes of **land surface fluxes, PBL and cloud/precipitation system** is essential. To achieve this goal, **GLASS, GABLS and GCSS should work together** based on new data sets to be obtained through the new experiments (e.g., AMMA, new Asian monsoon experiments and CEOP-2 campaigns) .
- **High-resolution & non-hydrostatic models** in the regional & global domain will solve many aspects of deficiencies in simulationg these processes. **GMPP should propose to use a global cloud-resolving model at Earth Simulator** .
- Climate models for predicting hydro-climate over land need to incorporate **new land surface schemes which include some new findings of time-lag effects of surface processes** (in snow cover, permafrost and vegetation).

Strategy for GEWEX Objective 5:
Undertake joint activities with operational hydro-meteorological services and hydrological research programmes to demonstrate the value of new GEWEX prediction capabilities, data sets and tools for assessing the consequences of climate predictions and global change.

- Before planning the strategy and timeline of these application studies, GEWEX-SSG should organize workshops or meetings for listening urgent and long-term needs from operational hydro-meteorological agencies and water-management community particularly of developing countries
- The visibility of GEWEX within ESSP projects (particularly in GWSP) is not clear. The role and contribution of GEWEX in ESSP (GWSP) can be realized, at least partly, through the collaboration of the CSEs with regional projects under ESSP. Through this collaboration, division of the roles played by GEWEX and GWSP should be clarified, in reference to interests, disciplines and capabilities of each program.

Research Aims of Global Water System Project (GWSP)

The Global Water System Project seeks to answer the fundamental and multi-faceted question:

How are humans changing the global water cycle, the associated biogeochemical cycles, and the biological components of the global water system and what are the social feedbacks arising from these changes?

- Three main research objectives of GWSP are:
- I. What are the main changes in the global water system and what are the key mechanisms by which they are induced?
 - II. What are the main linkages and feedbacks within the earth system arising from changes in the global water system?
 - III. How resilient and adaptable is the global water system to change, and what are sustainable water management strategies?

To fulfill this objective of GWSP, GEWEX needs to coordinate strongly!